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Fully Sulfonated Graft Copolymer Blends – a Structure-Property Relationship Study

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PerFluoroSulfonic Acids (PFSA) currently predominate as commercial state-of-the-art low temperature Proton Exchange Membranes (PEM), yet they suffer from especially high cost. Hence research to find alternatives is ongoing as large-scale commercialization of hydrogen powered PEM fuel cell cars in 2015 is approaching [1]. The current study is a continuation of the previously presented work by Holdcroft et al. [2 – 3]. Post-sulfonated (s) poly(vinylidene fluoride-*co*-chlorotrifluoroethylene)-*g*-polystyrene (P(VDF-*co*-CTFE)-*g*-sPS) at three different graft lengths are blended with PVDF to contain sPS volume fractions similar to that of a reference P(VDF-*co*-CTFE)-*g*-sPS with a different graft density and graft length. Proton conductivities are measured at 55-95% Relative Humidity (RH) and 25-80 °C, and water uptake is followed by dynamic vapor sorption. P(VDF-*co*-CTFE)-*g*-sPS show stronger dependence on both RH and temperature than benchmark PFSA Nafion®, with superior conductivities by up to a factor of two at 95% RH.

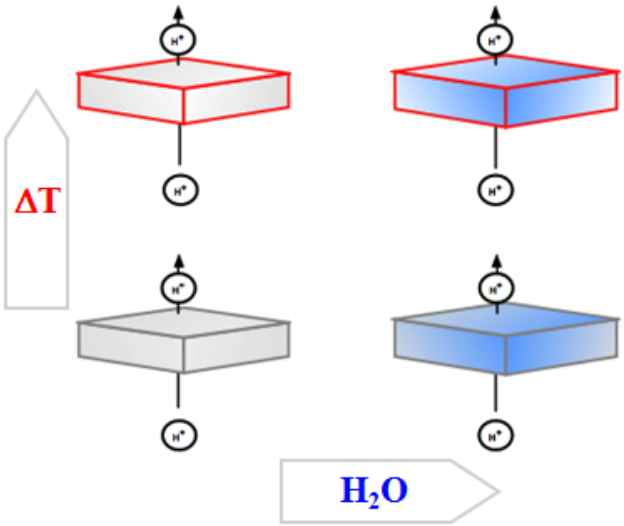

Figure 1. Proton conductivity is measured at various relative humidities and temperatures.

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